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Evaluation Gauge for Heat Sink Interface Material

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Abstract

Manufacturing facilities often need a way of evaluating the suitability of Thermal Interface Material (TIM) used with a heat sink. A technique is disclosed that evaluates heat sink Thermal Interface Material (TIM) for usability by using a gauge constructed to emulate a heat sink.

Description

This disclosure relates to the field of thermal management.

Manufacturing facilities often need a way of evaluating the suitability of Thermal Interface Material (TIM) used with a heat sink. Thermal interface materials are usually composed of a carrier and a thermally conductive filler. The intent of these materials is to form a tightly packed bed of thermally conductive filler with a continuous heat transfer path between the chip and the heat sink. The carrier material is intended to allow the thermally conductive material to shift into an alignment that minimizes spacing between the heat transfer surfaces, fills any micro air gaps, and packs the thermally conductive material tightly.

The current practice is for TIM material to be pre-applied by the heat sink manufacturer. However, TIM material has a limited shelf life, and significant degradation can take place within a short time as carrier material evaporates. If the carrier material has "dried out" the mobility of the thermally conductive filler is reduced. When pressure is applied to dried out TIM material during heat sink mounting, the filler will not flow into gaps, or out of the perimeter of the interface. As a result, the heat transfer surfaces will be further apart, and the thermally conductive material will not be packed efficiently. Processor heat sinks have such dried out thermal grease will result in greater thermal resistance, and in turn can cause throttling of the processors on which such heat sinks are used.

Up to now, factory floor personnel use their fingernail or a flat edged tool to test freshness. This method is very subjective, and often disturbs the interface material to the extent that it requires reapplication. In some cases, pre-applied thermal interface is simply removed and re-applied if its usability is suspect. However, this practice leads to wasted time and material, and often produces sub-standard results because the hand rework results are not always as consistent as the original screen process.

According to the present disclosure, and as understood with reference to the Figure, a test gauge emulates the installation of a heat sink by applying force over several small contact areas, allowing evaluation of grease spreading and bond line formation.

One example gauge 10 has a small plate 20 supported by 3 or 4 corner legs 30 of equal height attached to one side of the plate 20. The opposite side of the plate 20 has a flat top to allow attachment or application of weight to the gauge 10. The dead weight ensures

application of consistent and uniform force to the TIM material. The legs 30 have a flat bottom to imprint the TIM material and allow evaluation of flow. Two or more additional interior legs 40, 50 allow grease depth estimation against acceptable limits. In one example, an interior leg 40 is 0.1mm shorter than the outside legs, and an interior leg 50 is 0.2mm shorter than the outside legs.

In operation, the heat sink is placed on a flat surface with the TIM facing up. The gauge 10 is then placed on the TIM with the legs facing down, taking care to avoid lateral movement or pressure on the gauge 10 during placement. Then the weight is applied. In one example, a 1000g (1kg) weight is applied for one minute. After this, the weight and gauge 10 are removed vertically from the surface.

The following criteria can be considered during evaluation of the TIM material.

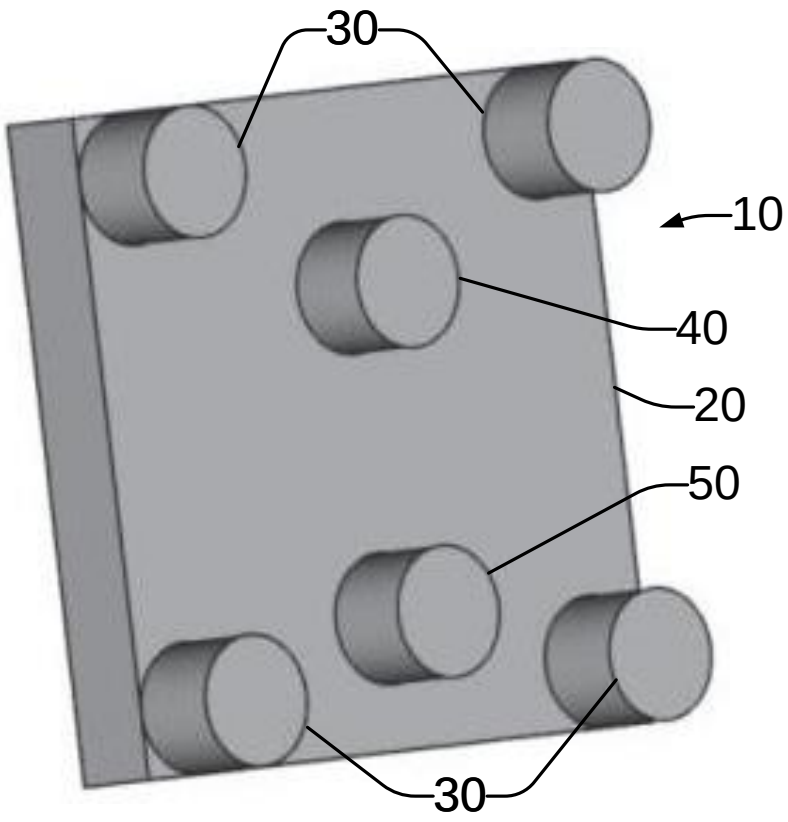
1) Impressions of the corner legs 30 should show even displacement of the TIM material. The material displacement should form substantial ridges with fluid appearance at the perimeter of the leg impression. The heat sink base should be visible through a thin layer of evenly distributed TIM material under the legs 30.

2) Contact with the shorter, interior legs 40, 50 should leave an impression based on TIM material thickness.

3) All material displacement should be smooth, even and fluid, with no cracking or asymmetry.

Failure to meet any of these criteria may indicate the need for removal and re-installation of the TIM material.

Advantageously, the gauge of the disclosed technique is simple to use and provides immediate results, avoiding factory line interruptions, and allowing for routine use. The gauge is inexpensive to fabricate and can be supplied to the floor personnel. USB microscope photos can provide evidence of the TIM material's compliance. The leg impressions are small, and tested heat sinks are still useable without rework.



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